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DESCRIPTION

DATA PROCESSING METHOD AND SYSTEM OF SAME, PORTABLE
DEVICE, DATA PROCESSING APPARATUS AND METHOD OF SAME, AND
PROGRAM

TECHNICAL FIELD

The present invention relates to a data processing
method enabling provision of a service of a plurality of
service providers by using a solitary IC (integrated
circuit) card and a system of the same, a portable
device, data processing apparatus and method of the same,
and a program.

BACKGROUND ART

In the past, in an IC card system, an IC card
carried by an individual has been recorded with various
personal information etc. and used for passing through
subway and train turnstiles, controlling entry to and
exiting from rooms, etc.

As opposed to this, as similar kinds of card-shaped
media, for example, pre-paid cards, service cards issued
by various stores, and user cards issued by software
manufacturers are in use.

These cards, including the IC cards, are
individually issued and supplied for use by the

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respective service providers (businesses) relating to the cards.

Note that by making it possible to give an IC card a capacity enabling it to sufficient store information
5 relating to several services in its built-in memory, several businesses could share use of an IC card.

In this way, businesses which had issued cards up until now could reduce the load in issuing cards and could secure a large number of users which are difficult
10 to secure by individual businesses. On the users' side, by enabling a reduction in the number of cards they carry and manage, they are relieved of the trouble of carrying and managing a large number of cards.

When an IC card is shared by several businesses in
15 this way, however, it becomes necessary to deal with a variety of requests compared with a case of one business issuing an exclusive IC card. That is, some businesses might desire the convenience of an IC card as if issued by itself even when using sharing an IC card with other
20 businesses. Also, specific businesses might not want to share an IC card. Furthermore, a reduction of the load at the sharing side may also be requested.

The present invention was made in consideration with the above points and has as an object thereof to provide
25 a data processing method and a system of the same, a

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portable device, a data processing apparatus and method
of the same, and a program capable of dealing with a
variety of demands including security aspects of a
service provider when a plurality of businesses share a
5 single IC card.

DISCLOSURE OF THE INVENTION

To attain the above object, a data processing method
of a first aspect of the present invention comprises a
data processing method for processing so that a portable
10 device mounting an integrated circuit storing key data
for dividing and first area management key data which is
authorized to perform at least one of a write operation
of data to a memory area of said integrated circuit and a
rewrite operation of data to the memory area conditional
15 on the use of the first area management key data makes a
second service provider provide a service using part of
said memory area of said integrated circuit when issued
by a first service provider providing a service using
said memory area, comprising having a memory area
20 operation unit managing said key data for dividing
encrypt first module data including second area
management key data by the key data for dividing by and
provide the same to the first service provider; having
the issuer of the portable device, that is, said first
25 service provider, encrypt second module data including

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the encrypted first module by using said first area management key data and provide the same to said memory area operation unit; and, under the control of the memory area operation unit, providing the encrypted second module data to the integrated circuit, decrypting the second module data by using the first area management key data in the integrated circuit, decrypting the first module data in the decrypted second module by using the key data for dividing, and dividing the memory area to a first memory area to be used for service of the first service provider and a second memory area to be used for service of the second service provider by using the second area management key data obtained by the decrypting.

15 In the above first data processing method, the second memory area used for service of the second service provider is suitably formed conditional on the second module being decrypted in the integrated circuit and the integrated circuit obtaining the second area management key data.

At this time, since the first module is encrypted by key data for dividing, the content of the second area management key data included in the second module can be kept secret from the first service provider. Therefore, 25 the first service provider cannot illicitly generate the

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second module without the permission of the memory area operation unit.

Further, the second module is encrypted by first area management key data, and the first area management key data is kept secret from the second service provider. Therefore, the memory area operation unit cannot illicitly generate a second module without permission from the first service provider.

Namely, since the second module cannot be generated without using both the first management key data and key data for dividing, the integrated circuit cannot obtain second area management key data necessary for generating the second memory area.

Further, since both of the key data for dividing and the first area management key data are kept secret from the second service provider, the second service provider cannot generate a second module.

Due to this, insofar as the first service provider, memory area operation unit, and second service provider suitably tie up to perform processing, the second memory area is not formed in the integrated circuit, so a high security can be realized.

Further, the data processing method of the first aspect of the present invention preferably has the integrated circuit divide the memory area into the first

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memory area wherein at least one of a write operation of data and a rewrite operation of data is authorized conditional on use of the first area management key data and the second memory area wherein at least one of a
5 write operation of data and a rewrite operation of data is authorized conditional on use of the second area management key data.

Further, the data processing method of the first aspect of the present invention preferably has the
10 integrated circuit further store first system key data and authorize at least one of a write operation of data to the memory area and a rewrite operation of data in the memory area conditional on use of the first system key data and the first area management key data; has the
15 memory area operation unit encrypt first module data further including second system key data by the key data for dividing and provide the same to the first service provider; has the first service provider encrypt second module data including the encrypted first module and
20 division condition information indicating the condition for dividing the memory area for use by another service provider by using the first area management key data and provide it to the memory area operation unit; and has the integrated circuit decrypt the second module data by
25 using the first area management key data, decrypt the

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first module data in the decrypted second module by using
the key data for dividing, and divide the memory area by
using the second system key data, second area management
key data, and division condition information obtained by
5 the decrypting.

Further, a data processing system of a second aspect
of the present invention comprises a data processing
system for processing so that a portable device mounting
an integrated circuit storing key data for dividing and
10 first area management key data which is authorized to
perform at least one of a write operation of data to a
memory area of said integrated circuit and a rewrite
operation of data to the memory area conditional on the
use of the first area management key data makes a second
15 service provider provide a service using part of said
memory area of said integrated circuit when issued by a
first service provider providing a service using said
memory area, wherein the system has a memory area
operation processing apparatus used by a memory area
20 operation unit which manages the key data for dividing, a
first service provider processing apparatus used by the
issuer of the portable device, that is, the first service
provider, and a second service provider processing
apparatus used by the first service provider; the memory
25 area operation processing apparatus encrypts first module

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data including second area management key data by the key data for dividing and sends the same to the first service provider processing apparatus; the first service provider processing apparatus encrypts second module data

5 including the received encrypted first module by using the first area management key data and sends the same to the memory area operation processing apparatus; the memory area operation processing apparatus provides the received encrypted second module data to the integrated
10 circuit; and the integrated circuit decrypts the second module data by using the first area management key data, decrypts the first module data in the decrypted second module by using the key data for dividing, and divides the memory area to a first memory area to be used for
15 service of the first service provider and a second memory area to be used for service of the second service provider by using the second area management key data obtained by the decrypting under control of the memory area operation unit.

20 Further, a portable device according to a third aspect of the present invention is a portable device mounting an integrated circuit used for a first service provider providing a service wherein the integrated circuit comprises a memory means for storing key data for
25 dividing managed by a memory area operation unit

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performing processing to make a second service provider
provide a service using a part of a memory area of the
integrated circuit and first area management key data; an
input means for inputting a module including second area
5 management key data issued by the memory area operation
unit which is encrypted by the memory area operation unit
by using the key data for dividing and furthermore
encrypted by the first service provider by using the
first area management key data; and a processing means
10 for decrypting the input module by using the key data for
dividing and the first area management key data, dividing
a memory area of the memory means to a first memory area
and a second memory area by using the second area
management key data in the decrypted module, authorizing
15 at least one of a write operation of data to the first
memory area and a rewrite operation of data in the memory
area conditional on use of the first area management key
data and authorizing at least one of a write operation of
data to the second memory area and a rewrite operation of
20 data in the memory area conditional on use of the second
area management key data.

Further, a data processing apparatus according to a
fourth aspect of the present invention is a data
processing apparatus for processing so that a portable
25 device mounting an integrated circuit storing

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distribution key data, a system code for identifying a first service provider, and first area management key data which is authorized to perform at least one of a write operation of data to a memory area of said

5 integrated circuit and a rewrite operation of data to the memory area conditional on the use of the first area management key data makes a second service provider provide a service using part of said memory area of said integrated circuit when issued by a first service

10 provider providing a first service using said memory area, wherein the apparatus has a memory means, processing means, and input/output means; the memory means stores rejection information for specifying a service provider which can provide service by the same

15 integrated circuit indicated by the first service provider and the second service provider; the processing means encrypts a first module including second management key data by using the key data for dividing; the input/output means outputs the encrypted first module to

20 provide it to the first service provider, receives as input a second module including the encrypted first module and encrypted in the first service provider by using the first area management key data, and outputs the second module to provide it to a memory area division

25 apparatus for dividing the memory area under control of

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the second service provider so that a part of the memory area of the integrated circuit can be used by the second service provider; the processing means generates a registerable system code list indicating the system code added to the first service provider which can provide service by the same integrated circuit as the second service provider based on the rejection information; and the input/output means outputs the system code list to provide it to the memory area division apparatus.

10 Further, a data processing apparatus according to a fifth aspect of the present invention is a data processing apparatus for processing so that a portable device mounting an integrated circuit storing distribution key data, a system code for identifying a first service provider, and first area management key data which is authorized to perform at least one of a write operation of data to a memory area of said integrated circuit and a rewrite operation of data to the memory area conditional on the use of the first area management key data makes a second service provider provide a service using part of said memory area of said integrated circuit when issued by a first service provider providing a first service using said memory area, wherein the apparatus has a memory means, 25 input/output means, and processing means; the memory

means stores a module including second area management
key data issued by a memory area operation unit for
managing processing of the data processing apparatus and
encrypted by the memory area operation unit by using the
5 key data for dividing and a registerable system code list
indicating the system code added to the first service
provider which can provide service by the same integrated
circuit as the second service provider; the input/output
means receives as input the system code from the
10 integrated circuit; and the processing means outputs the
module to the integrated circuit via the input/output
means when it judges that the input system code is
indicated in the registerable system code list.

Further, a data processing apparatus according to a
15 sixth aspect of the present invention is a data
processing apparatus for performing processing to write
file data in a second memory area of an integrated
circuit having a first memory area wherein at least one
of a write operation and rewrite operation of file data
20 used for providing a first service is authorized
conditional on use of first area management key data and
a second memory area wherein at least one of a write
operation and rewrite operation of file data used for
providing a second service is authorized conditional on
25 use of second area management key data, comprising a

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memory means storing third area management data and file
key data which is issued by the second service provider,
used at the time of writing the file data to a third
memory area, and encrypted by the third area management
5 key data when a plurality of third memory areas are
defined in the second memory area, third memory
management key data used for performing at least one of a
write operation of data to a third memory area and a
rewrite operation of data in the third memory area is
10 defined for each of the plurality of third memory areas,
and said integrated circuit stores said third area
management key data; an output means for outputting the
encrypted file key data to the integrated circuit; and a
writing means for writing file data to be used for
15 providing the second service to the second memory area of
the integrated circuit by using the file key data.

Further, a portable unit issuing method according to
a seventh aspect of the present invention comprises
issuing a portable unit mounting an integrated circuit
20 storing key data for dividing and first area management
key data and authorizing at least one of a write
operation of data to a memory area in said integrated
circuit and a rewrite operation of data in the memory
area conditional on use of the first area management key
25 data and requesting a memory area operation unit managing

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the key data for dividing to divide the memory area of the integrated circuit to a first memory area wherein at least one of a write operation of data and re-write data in the memory area is authorized conditional on use of the first area management key data and a second memory area wherein at least one of a write operation of data and a rewrite operation of data in the memory area is authorized conditional on use of the second area management key data by using the key data for dividing.

Further, a program according to an eighth aspect of the present invention is a program for making a computer execute processing so that a portable device mounting an integrated circuit storing key data for dividing, a system code for identifying a first service provider, and first area management key data which is authorized to perform at least one of a write operation of data to a memory area of said integrated circuit and a rewrite operation of data to the memory area conditional on the use of the first area management key data makes a second service provider provide a service using part of said memory area of said integrated circuit when issued by a first service provider providing a first service using said memory area, comprising making the computer execute a routine for receiving as input the system code from the integrated circuit; a routine for referring to a

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registerable system code list indicating the system code
given to the first service provider which can provide a
service by the same integrated circuit as the second
service provider and judging whether the input system
5 code is indicated in the registerable system code list;
and a routine for outputting to the integrated circuit a
module including second area management data issued by a
memory area operation unit managing execution of the
program and encrypted by the memory area operation unit
10 by using the key data for dividing and further encrypted
by the first service provider by using the first area
management key data when judging that the input system
code is indicated in the registerable system code list.

Further, a data processing method according to a
15 ninth aspect of the present invention is a data
processing method for processing so that a portable
device mounting an integrated circuit storing
distribution key data, a system code for identifying a
first service provider, and first area management key
20 data which is authorized to perform at least one of a
write operation of data to a memory area of said
integrated circuit and a rewrite operation of data to the
memory area conditional on the use of the first area
management key data makes a second service provider
25 provide a service using part of said memory area of said

integrated circuit when issued by a first service
provider providing a first service using said memory
area, comprising a routine of inputting the system code
from the integrated circuit; a routine of referring to a
5 registerable system code list indicating the system code
given to the first service provider which can provide
service by the same integrated circuit as the second
service provider and judging whether the input system
code is indicated in the registerable system code list;
10 and a routine of outputting to the integrated circuit a
module including second area management data issued by a
memory area operation unit managing execution of the
program and encrypted by the memory area operation unit
by using the key data for dividing and further encrypted
15 by the first service provider by using the first area
management key data when it judges that the input system
code is indicated in the registerable system code list.

Further, a program according to a 10th aspect of the
present invention is a program for making a computer
20 execute processing for writing file data to a second
memory area of an integrated circuit having a first
memory area wherein at least one of a write operation and
rewrite operation of file data used for providing a first
service is authorized conditional on use of first area
25 management key data and a second memory area wherein at

least one of a write operation and rewrite operation of
file data used for providing a second service is
authorized conditional on use of second area management
key data, comprising making the computer execute a
5 routine of outputting to the integrated circuit file key
data which is issued by a second service provider, used
at the time of writing the file data in a third memory
area, and encrypted by a third area management data when
a plurality of third memory areas are defined in the
10 second memory area, a third memory management key data
used for performing at least one of a write operation of
data to a third memory area and a rewrite operation of
data in the third memory area is defined for each of the
plurality of third memory areas, and the integrated
15 circuit stores the third area management key data and a
routine of writing file data used for providing the
second service in the second memory area of the
integrated circuit by using the file key data.

Further, a data processing method according to an
20 11th aspect of the present invention is a data processing
method for performing processing for writing file data to
a second memory area of an integrated circuit having a
first memory area wherein at least one of a write
operation and rewrite operation of file data used for
25 providing a first service is authorized conditional on

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use of first area management key data and a second memory area wherein at least one of a write operation and rewrite operation of file data used for providing a second service is authorized conditional on use of second

5 area management key data, comprising a routine of outputting to the integrated circuit file key data which is issued by a second service provider, used at the time of writing the file data in a third memory area, and encrypted by a third area management data when a

10 plurality of third memory areas are defined in the second memory area, a third memory management key data used for performing at least one of a write operation of data to a third memory area and a rewrite operation of data in the third memory area is defined for each of the plurality of

15 third memory areas, and the integrated circuit stores the third area management key data and a routine of writing file data used for providing the second service in the second memory area of the integrated circuit by using the file key data.

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BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a view of the overall configuration of a communication system according to an embodiment of the present invention in a first embodiment;

25 FIG. 2 is a block diagram of the functions of an IC

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card shown in FIG. 1;

FIG. 3 is a view for explaining data stored in a memory of the IC card shown in FIG. 2 after issuance by an IC card issuer and before operation processing by a

5 card memory area operator 22;

FIG. 4 is a block diagram of the functions of an issuer communication apparatus 11 shown in FIG. 1;

FIG. 5 is a block diagram of the functions of an operator communication apparatus 11 shown in FIG. 1;

10 FIG. 6 is a block diagram of the functions of a memory area division apparatus shown in FIG. 1;

FIG. 7 is a block diagram of the functions of an operation file registration apparatus shown in FIG. 1;

15 FIG. 8 is a flowchart for explaining an outline of an overall operation of the communication system shown in FIG. 1;

FIG. 9 is a flowchart for explaining package data generation processing of step ST1 shown in FIG. 8;

20 FIG. 10A, FIG. 10B, and FIG. 10C are views for explaining package data Pf and Pj;

FIG. 11 is a flowchart for explaining delivery and setting of a memory area division apparatus at step ST2 shown in FIG. 8;

FIG. 12 is a view for explaining first issued data;

25 FIG. 13 is a flowchart for explaining what follows

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from the setting of the memory area division apparatus 14 at step ST3 shown in FIG. 8;

FIG. 14A is a view for explaining an area code acquisition request;

5 FIG. 14B is a view for explaining an apparatus code list;

FIG. 14C is a view for explaining an area management code list;

10 FIG. 15A is a view for explaining a registerable system code list;

FIG. 15B is a view for explaining area registration permission data;

15 FIG. 16 is a view for explaining data stored in the memory of the memory area division apparatus after completing step ST3 shown in FIG. 8;

FIG. 17 is a view for explaining what follows the setting of an operation file registration apparatus at step ST4 shown in FIG. 8;

20 FIG. 18 is a view for explaining data stored in the operation file registration apparatus after completing step ST4 shown in FIG. 8;

FIG. 19A and FIG. 19B are views for explaining file registration permission data;

25 FIG. 20 is a flowchart for explaining memory area division processing of the IC card by the memory area

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division apparatus performed at step ST5 shown in FIG. 8;

FIG. 21 is a flowchart continued from FIG. 20;

FIG. 22 is a view for explaining a state after dividing the memory area of the IC card;

5 FIG. 23 is a view for explaining a state after defining an area "AREA" in the memory area of the IC card;

FIG. 24 is a view for explaining registration processing of file data to the IC card by the operation
10 file registration apparatus performed at step ST6 shown in FIG. 8;

FIG. 25 is a view for explaining the memory area of the IC card after the registration of the file data;

FIG. 26 is a block diagram for explaining division
15 of a memory space in an IC card system explained with reference to the embodiment of the present invention;

FIG. 27 is a block diagram showing the IC card system shown in FIG. 26;

FIG. 28 is a simplified diagram for explaining the
20 memory space of the IC card shown in FIG. 26;

FIG. 29 is a simplified diagram of the memory space after division;

FIG. 30 is a simplified diagram for explaining pre-processing of rejection processing in the IC card system
25 shown in FIG. 26;

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FIG. 31 is a simplified diagram for explaining processing continued from the processing in FIG. 30;

FIG. 32 is a simplified diagram for explaining processing continued from the processing in FIG. 31; and

5 FIG. 33 is a simplified diagram for explaining registration processing in the IC card system shown in FIG. 26.

BEST MODE FOR CARRYING OUT THE INVENTION

10 Below, the best mode for carrying out the present invention will be explained with reference to the attached drawings.

FIG. 1 is a view of the overall configuration of a communication system 1 according to an embodiment of the
15 present invention.

As shown in FIG. 1, the communication system 1 comprises, for example, an issuer communication apparatus 11 to be used by an IC card issuer 21, an operator communication apparatus 12 to be used by a card memory
20 area operator 22, a manufacturer communication apparatus 13 to be used by an apparatus manufacturer 23, and a memory area division apparatus 14 and an operation file registration apparatus 15 to be used by a card memory area user 24.

25 In the communication system 1, when the IC card

issuer 21 issues an IC card 16 to a card holder 26, it registers file data related to services provided by the card memory area user 24 in the IC card 16 based on predetermined conditions so that the card holder 26 can
5 receive services from both the IC card issuer 21 and the card memory area user 24 by using the IC card 16 alone.

As shown in FIG. 1, in the communication system 1, the issuer communication apparatus 11, the operator communication apparatus 12, the manufacturer
10 communication apparatus 13, the memory area division apparatus 14, and the operation file registration apparatus 15 are connected via a network 17.

In FIG. 1, the IC card issuer 21 issues the IC card 16 and provides its own service by using the IC card 16.

15 The card memory area operator 22 receives a request from the IC card issuer 21 and provides a service of lending the card memory area user 24 a memory area that the IC card issuer 21 does not use in the memory area of the memory (semiconductor memory) in the IC card 16
20 issued by the IC card issuer 21.

The apparatus manufacturer 23 receives a request from the card memory area operator 22, produces the memory area division apparatus 14, and delivers the same to the card memory area user 24.

25 The card memory area user 24 issues a request to the

card memory area operator 22 and provides its own service by using the memory area of the IC card 16.

The card holder 26 is issued the IC card 16 by the IC card issuer 21 and receives the services provided by the IC card issuer 21. When the card holder 26 desires to receive services provided by the card memory area user 24 after the issuance of the IC card 16, it is possible to store file data related to the services of the card memory area user 24 in the IC card 16 by using the memory area division apparatus 14 and the operation file registration apparatus 15 so as to receive the services by the card memory area user 24.

In providing services by the IC card issuer 21 and services by the card memory area user 24 by using the single IC card 16, the communication system 1 is configured so that it is difficult for an unauthorized person to illicitly write and rewrite data in a memory area where the file data related to the services of the IC card issuer 21 and the card memory area user 24 is stored.

Note that in FIG. 1, the case where there are only one of each of the IC card issuer 21, the card memory area user 24, and the card holder 26 is shown as an example, but one or more of each of them may be provided.

Also, the correspondence of the components of the

present embodiment and the components of the claims is, for example, that the IC card issuer 21 and the issuer communication apparatus 11 correspond to the first service provider of the present invention. Also, the card memory area user 24 corresponds to the second service provider of the present invention. The operator communication apparatus 12 and the card memory area operator 22 correspond to the memory area operator of the present invention.

Also, the area management key data K_AM_(i) corresponds to the first area management key data of the present invention and the area management key data K_AM_F corresponds to the second area management key data of the present invention.

Furthermore, the IC card 16 corresponds to the portable device provided with an integrated circuit of the present invention.

Note that in the present embodiment, the IC card 16 is shown as an example of the portable device of the present invention, but for example the portable device of the present invention may also be a portable telephone device, portable information terminal apparatus, etc. provided with an IC (integrated circuit).

Also, package data Pf corresponds to the first module of the present invention, while package data Pj

corresponds to the second module of the present invention.

Also, an uppermost area AREA_MU_(i) corresponds to a first memory area of the present invention, while an uppermost area AREA_MU_F corresponds to a second area memory area of the present invention. Also, a lower layer of the area AREA of the uppermost area AREA_MU_F corresponds to the third memory area of the present invention.

First, the components of the communication system 1 shown in FIG. 1 will be explained.

[IC card 16]

FIG. 2 is a block diagram of the functions of the IC card 16 shown in FIG. 1.

As shown in FIG. 2, the IC card 16 comprises, for example, an input/output interface 31, a memory 32, and a processor 33.

The input/output interface 31 is an interface for inputting/outputting data and requests by a non-contact method or a contact method between the memory area division apparatus 14 and the operation file registration apparatus 15 when mounted in the memory area division apparatus 14 and the operation file registration apparatus 15, respectively.

The memory 32 is for example a semiconductor memory

which stores data related to services provided by the IC card issuer 21 and the card memory area user 24 and data related to an operation by the card memory area operator 22 as will be explained later.

5 The processor 33 performs processing related to the functions of the IC card 16.

FIG. 3 is a view for explaining data stored in the memory 32 of the IC card 16 shown in FIG. 2 after the issuance by the IC card issuer 21 and before operation
10 processing by the card memory area operator 22.

As shown in FIG. 3, the memory 32 stores a system code SYSC_(i) assigned to the IC card issuer 21 and system key data SYS_K_(i) linked with the system code SYSC_(i).

15 Also, as shown in FIG. 3, the memory 32 for example has a hierarchical structure wherein the uppermost memory area AREA_MU_(i) is the uppermost layer and a plurality of areas AREA_(i) are defined as lower layers thereof. An area AREA_(i) may be furthermore defined as a lower layer
20 of the area AREA shown in FIG. 3.

The uppermost area management key data K_MU_(i) is assigned to the uppermost memory area AREA_MU_(i).

The areas AREA_(i) are assigned the area management code AMC_(i) and area management key data K_AM_(i).

25 Also, a plurality of file data FILE_(i) for

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performing processing related to services provided by the IC card issuer 21 are set (stored) in the area AREA_(i).

Also, in correspondence to the file data FILE_(i), the memory 32 stores service codes SC_(i) assigned to services provided by using the file data and file management key data K_FM_(i) used for setting the file data FILE_(i).

[Issuer Communication Apparatus 11]

FIG. 4 is a block diagram of the functions of the issuer communication apparatus 11 shown in FIG. 1.

As shown in FIG. 4, the issuer communication apparatus 11 comprises for example a communication interface 41, a memory 42, and a processor 43.

The issuer communication apparatus 11, as shown in FIG. 3, performs processing for encrypting the package data Pf received from the operation communication apparatus 12 by using the system key data SYS_K_(i) stored in the memory 32 of the IC card 16 in a secured state (secret state) so as to generate the package data Pj as will be explained later.

Note that the system key data SYS_K_(i) is known only by the IC card issuer 21 and kept secret from the card memory area operator 22, the apparatus manufacturer 23, and the card memory area user 24 shown in FIG. 1.

The communication interface 41 is an interface for

sending/receiving data with the operation communication apparatus 12 via the network 17.

The memory 42 stores various data shown in FIG. 3 stored in the IC card 16 issued by the IC card issuer 21.

5 The processor 43 performs processing (generation of Pj) related to lending of the memory 32 of the IC card 16 with the operation communication apparatus 12 as will be explained later.

[Operator Communication Apparatus 12]

10 FIG. 5 is a block diagram of the functions of the operator communication apparatus 12 shown in FIG. 1.

As shown in FIG. 5, the operator communication apparatus 12 comprises for example a communication interface 51, a memory 52, and a processor 53.

15 The operator communication apparatus 12 manages a variety of processing for lending a memory area of the memory 32 of the IC card 16 to the card memory area user 24.

20 The communication interface 51 is an interface for sending/receiving data between the issuer communication apparatus 11, the memory area division apparatus 14, and the operation file registration apparatus 15 via the network 17.

25 The memory 52 stores a system code SYSC_F related to a new memory area to be formed by dividing the memory

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area of the memory 32 of the IC card 16 and system key data SYS_K_F corresponding to the system code SYSC_F etc.

Also, the memory 52 stores division key data K_D.

The processor 53 performs various processing for
5 lending a memory area of the memory 32 of the IC card 16 to the card memory area user 24 as will be explained later.

[Memory Area Division Apparatus 14]

FIG. 6 is a block diagram of the functions of the
10 memory area division apparatus 14 shown in FIG. 1.

The memory area division apparatus 14 is for example provided to a store etc. of the card memory area user 24. Note that the memory area division apparatus 14 may also be provided at a store etc. of the operator communication
15 apparatus 12.

Also, the memory area division apparatus 14 is produced by the apparatus manufacturer 23 and delivered to the card memory area user 24.

As shown in FIG. 6, the memory area division
20 apparatus 14 for example comprises a communication interface 61, a card interface 62, an operator 63, a memory 64, and a processor 65.

The communication interface 61 is an interface for sending/receiving data with the operator communication
25 apparatus 12 via the network 17.

The card interface 62 is an interface connected to the input/output interface 31 of the IC card 16 shown in FIG. 2 which inputs/outputs data and requests from/to the input/output interface 31 when the IC card 16 is mounted in the memory area division apparatus 14.

The operator 63 is used for example when the card holder 26 who visited a store of the card memory area user 24 inputs an instruction.

The memory 64 stores data required for processing of the processor 65.

The processor 65 performs processing for dividing the memory area of the memory 32 of the IC card to form a memory area for writing file data related to the services of the card memory area user 24.

[Operation File Registration Apparatus 15]

FIG. 7 is a block diagram of the functions of the operation file registration apparatus 15 shown in FIG. 1.

The operation file registration apparatus 15 is for example provided at a store etc. of the card memory area user 24.

As shown in FIG. 7, the memory area division apparatus 14 for example comprises a communication interface 71, a card interface 72, an operator 73, a memory 74, and a processor 75.

The communication interface 71 is an interface for

sending/receiving data with the operator communication apparatus 12 via the network 17.

The card interface 72 is an interface connected to the input/output interface 31 of the IC card 16 shown in FIG. 2 which inputs/outputs data and requests to/from the input/output interface 31 when the IC card 16 is mounted in the operation file registration apparatus 15.

The operator 73 is used by a card holder 26 who visits a store of the card memory area user 24 to input an instruction.

The memory 74 stores data required for processing of the processor 75.

The processor 75 performs processing for writing file data used for processing related to the services provided by the memory area division apparatus 14 in the memory area divided by the above memory area division apparatus 14.

Below, an example of the operation of the communication system 1 shown in FIG. 1 will be explained.

First, an outline of the overall operation of the communication system shown in FIG. 1 will be explained.

FIG. 8 is a flowchart for explaining the outline of the overall operation of the communication system 1 shown in FIG. 1.

Step ST1:

The operator communication apparatus 12 generates package data Pf including a system code SYSC_F used at the time of dividing the memory area of the memory 32 of the IC card 16 and uppermost area management key data K_MU_F, encrypts it by division key data K_D and sends it. The issuer communication apparatus 11 encrypts the package data Pf by using the system key data SYS_K_(i) to generate package data Pj which is sent to the operator communication apparatus 12.

10 The package data Pj is held by the operator communication apparatus 12.

Step ST2:

The memory area division apparatus 14 is delivered from the apparatus manufacturer 23 to the card memory area user 24.

Also, the system code SYSC_(i) and the package data Pj etc. are sent from the operator communication apparatus 12 to the memory area division apparatus 14 and stored in the memory area division apparatus 14.

20 Step ST3:

A registerable system code list RPSL and area registration permission data INF_ARP are sent from the operator communication apparatus 12 to the memory area division apparatus 14 and stored in the memory area division apparatus 14.

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The registerable system code list RPSL includes a system code of the IC card 16 to which file data of services related to the card memory area user 24 can be registered by using the memory area division apparatus

5 14.

The area registration permission data INF_ARP is used for registering an area AREA_F defined in a new memory area obtained by dividing the memory area of the IC card 16.

10 Step ST4:

The area management key data K_QM_F is provided by a secured path from the operator communication apparatus 12 to the operation file registration apparatus 15.

15 Here, the area management data K_AM_F is used at the time of writing file data in one or more areas AREA_F defined in the new memory area formed by dividing the memory area of the IC card 16.

Also, file registration permission data FRP is generated in the operation file registration apparatus
20 15.

Step ST5:

For example, when the card holder 26 loads the IC card 16 in the memory area division apparatus 14, the memory area division apparatus divides the memory area of
25 the memory 32 of the IC card 16 by performing

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predetermined processing to define a memory area used by
the IC card issuer 21 (the uppermost area AREA_MU_(1)
shown in FIG. 3) and a new memory area used by the card
memory area user 24 (the uppermost area management key
5 data area_MU_F).

Step ST6:

When the card holder loads the IC card 16 in the
operation file registration apparatus 15, file data
related to the service provider provided by the card
10 memory area user 24 is written by using the file
registration permission data FRP in the new memory area
defined at step ST5.

As a result, the card holder 26 can receive services
both by the IC card issuer 21 and the card memory area
15 user 24 by using the IC card 16 alone.

Below, each of the steps shown in FIG. 8 will be
explained in detail by using a flowchart.

[Package Data Generation Processing (ST1)]

First, package data generation processing of the
20 step ST1 shown in FIG. 8 will be explained.

FIG. 9 is a flowchart for explaining the processing.

Step ST21:

The processor 53 of the operator communication
apparatus 12 shown in FIG. 1 and FIG. 5, as shown in FIG.
25 10A, divides the memory area of the memory 32 of the IC

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card 16 and generates the package data Pf including the
system code SYSC_F of the uppermost area AREA_MU_F of a
memory area to be newly formed in addition to the
uppermost area AREA_MU_(1) and the corresponding system
5 key data SYS_K_F.

Step ST22:

The processor 53 of the operator communication
apparatus 12, as shown in FIG. 10B, encrypts the package
data Pf generated at step ST1 by using division key data
10 K_D read from the memory 52.

Step ST23:

The package data Pf generated at step ST22 is sent
to the issuer communication apparatus 11 via the
communication interface 51 of the operator communication
15 apparatus 12 and the network 17.

The package data Pf is received by the communication
interface 41 of the issuer communication apparatus 11
shown in FIG. 4.

Step ST24:

20 The processor 43 of the operator communication
apparatus 11 shown in FIG. 4 generates the package data
Pj including division block number data for defining a
memory capacity of the memory area which is requested to
be operated by (lent to) the card memory area operator 22
25 in the memory capacity of the memory 32 of the IC card 16

Step ST25:

Step ST26:

These are received by the communication interface 51
15 of the operator communication apparatus 12 shown in FIG.
5.

Step ST27:

The processor 53 of the operator communication apparatus 12 shown in FIG. 5 writes in the memory 52 the system code SYSC(i), the rejection information RI(i), and the encrypted package data Pj received at step ST26.

Next, processing for delivery and setting of the memory area division apparatus 14 at step ST2 shown in FIG. 8 will be explained.

Step ST31:

Step ST32:

Step ST33:

The above steps ST31 to ST33 are performed by using a personal computer of the card memory area user 24, telephone, and mail.

Step ST34:

The apparatus manufacturer 23 inquires about the legitimacy of the apparatus code AC to the card memory area operator 22 when needed in accordance with the delivery request received at step ST33 and delivers the memory area division apparatus 14 storing the apparatus code AC to the card memory area user 24.

Step ST35:

When the card memory area operator 22 receives for example a delivery completion notice of the memory area division apparatus 14 from the card memory area user 24, it reads the system code SYSC_(1), the encrypted package data Pj, and first issuance data INF_1 from the memory 52 under the control of the processor 53 of the operator communication apparatus 12 shown in FIG. 5 and sends the same to the memory area division apparatus 14 via the communication interface 51 and the network 17.

The data is received by the communication interface 61 of the memory area division apparatus 14 shown in FIG. 6.

Here, the first issuance data INF_1 is, for example as shown in FIG. 12, data obtained by encrypting module data including the uppermost area management data K_MU_F and the system code SYSC_F by the upper most area management key data K_MU_F.

Step ST36:

The processor 65 of the memory area division apparatus 14 shown in FIG. 6 writes in the memory 64 the system code SYSC_(1), the encrypted package data Pj, and
5 the first issuance data information INF_1 received at step ST35.

[Continuation of Setting of Memory Area Division Apparatus 14 (ST3)]

Next, a continuation of the setting of the memory
10 area division apparatus 14 at step ST3 shown in FIG. 8 will be explained.

FIG. 13 is a flowchart for explaining the processing.

Step ST41:

15 The card memory area user 24 operates the operator 63 of the memory area division apparatus 14 shown in FIG. 14 to input an area management code acquisition instruction. Due to this, an area management code acquisition request REQ_AMC shown in FIG. 14A is sent to
20 the operator communication apparatus 12 via the communication interface 61 and the network 17.

The area management code acquisition request is received by the communication interface 51 of the operator communication apparatus 12 shown in FIG. 5.

25 As shown in FIG. 14A, the area management code

acquisition request REQ_AMC indicates the apparatus code AC, rejection information RI_F, number of registration areas, number of blocks of each of the registration areas, and number of service codes by in correspondence.

5 Here, the apparatus code AC is notified to the card memory area user 24 from the card memory area operator 22 at step ST32 shown in FIG. 11.

10 The rejection information RI_F is information for specifying a party for which provision of services by using the same IC card 16 is rejected by the IC card issuer 21.

15 The number of registration areas is the number of areas AREA_F the card memory area user 24 desires to use for storing file data relating to its own services and defined after division of the memory 32 of the IC card 16.

 The number of blocks of each of the registration areas is the number of blocks assigned to the area AREA.

20 The number of service codes is the number of service codes which the card memory area user 24 desires to use for storing file data relating to its own services.

 Step ST42:

25 When the processor 53 of the operator communication apparatus 12 shown in FIG. 5 receives the area management code acquisition request at step ST41, it generates an

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apparatus code list MCL and an area management code list
ACL and stores the same in the memory 52.

The apparatus code list ACL indicates, as shown in
FIG. 14B, the apparatus code AC assigned to the memory
5 area division apparatus 14, the area management code
AMC_F (application code) assigned to one or more areas
AREA defined in the memory management area divided by the
memory area division apparatus 14, and the rejection
information RI_F received at step ST41 in correspondence.

10 Furthermore, the area management code list AMCL is,
as shown in FIG. 14C, generated for every area management
code AMC_F (application code) indicated by the apparatus
code list ACL in FIG. 14B and indicates the area
management code AMC_F (application key), the area
15 management key data K_AM_F corresponding to the
corresponding area AREA_F, and file data written in the
area AREA_F in correspondence.

Step ST43:

The processor 53 of the operator communication
20 apparatus 12 shown in FIG. 5 uses the same IC card 16 as
that of the card memory area user 24 to specify the IC
card issuer 21 which can provide services based on the
rejection information RI_(1) stored in the memory 52 at
step ST27 shown in FIG. 9 and the rejection information
25 RI_F stored at step ST41.

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Step ST44:

The processor 53 of the operator communication apparatus 12 uses the system code assigned to the IC card issuer 21 specified at step ST43 to generate a
5 registerable system code list RPSL.

The registerable system code list RPSL indicates, as shown in FIG. 15A, the apparatus code AC assigned to the memory area division apparatus 14 and the system code SC assigned to one or more IC card issuers 21 specified at
10 step ST43 in correspondence.

Step ST45:

The processor 53 of the operator communication apparatus 12 encrypts the area management code list AMCL generated at step ST42 and shown in FIG. 14C by the
15 uppermost area management key data K_MU_F to generate area registration permission data INF_ARP.

Step ST46:

The processor 53 of the operator communication apparatus 12 sends the registerable system code list RPSL
20 and the area registration permission data INF_ARP generated at step ST45 to the memory area division apparatus 14 via the communication interface 51 and the network 17.

These are received by the communication interface 61
25 of the memory area division apparatus 14 shown in FIG. 6.

Step ST47:

The processor 65 of the memory area division apparatus 14 shown in FIG. 6 stores the registerable system code list RPSL and the area registration permission data INF_ARP received at step ST46 in the memory 64.

At the stage of completing the above steps up to the step ST3 shown in FIG. 8, the memory 64 of the memory area division apparatus 14 stores, as shown in FIG. 16, the encrypted package data Pj shown in FIG. 10C, the encrypted first issuance data INF_1 shown in FIG. 16, the registerable system code list RPSL shown in FIG. 15A, and the encrypted area registration permission data INF_ARP shown in FIG. 15B.

15 [Operation File Registration Apparatus 15 (ST4)]

Next, a continuation of the setting of the operation file registration apparatus 15 of step ST4 shown in FIG. 8 will be explained.

FIG. 17 is a flowchart for explaining the processing.

Step ST51:

The processor 53 of the operator communication apparatus 12 shown in FIG. 5 sends the area management key data K_AM_F issued at the time of generating the apparatus code list ACL at step ST42 shown in FIG. 13 via

the communication interface 51 and the network 17 to the operation file registration apparatus 15 or uses other means to notify the card memory area user 24.

Step ST52:

5 The processor 53 of the operator communication apparatus 12 sends the area management code AMC_F issued at the time of generating the above apparatus code list ACL and the service code SC via the communication interface 51 and the network 17 to the operation file registration apparatus 15.

Step ST53:

10 The processor 53 of the operator communication apparatus 12 shown in FIG. 7 generates, as shown in FIG. 19A, the file registration permission data FRP indicating the service codes SC and the file management key data K_FM_F determined by the card memory area user 24 in accordance with the service code SC in correspondence for one or more the service codes SC received at step ST52.

Step ST54:

20 The processor 53 of the operator communication apparatus 12 shown in FIG. 7 encrypts the file registration permission data FRP generated at step ST53 by using the area management key data K_AM_F received at step ST51 and stores the same in the memory 52 as shown in FIG. 19B.

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At the stage of completing the above processing up to the step ST4 shown in FIG. 8, the memory 52 of the operation file registration apparatus 15 stores, as shown in FIG. 18, the area management code AMC_F, the area management key data K_AM_F, and the encrypted file registration permission data FRP shown in FIG. 19B.

[Memory Area Division Processing of IC Card 16 by Memory Area Division Apparatus 14 (ST5)]

Next, the memory area division processing of the IC card 16 by the memory area division apparatus 14 performed at step ST5 shown in FIG. 8 will be explained.

FIG. 20 and FIG. 21 are flowcharts for explaining the processing.

Step ST61:

The IC card holder 26 visits a store of the card memory area user 24 carrying the IC card 16 and loads the IC card 16 in the memory area division apparatus 14.

Consequently, the system code SYSC_(i) stored in the memory 32 of the IC card 16 is read and output to the memory area division apparatus 14 via the input/output interface 31.

The system code SYSC_(i) is input to the card interface 62 of the memory area division apparatus 14 shown in FIG. 6.

Step ST62:

The processor 65 of the memory area division apparatus 14 shown in FIG. 6 reads from the memory 64 the package data Pj and the first issuance data INF₁ corresponding to the system code SYSC₍₁₎ input at step
5 ST61.

Step ST63:

The processor 65 of the memory area division apparatus 14 outputs to the IC card 16 the respectively encrypted package data Pj and first issuance data INF₁
10 read at step ST62 via the card interface 62.

Step ST64:

The processor 33 of the IC card 16 shown in FIG. 2 first uses the uppermost area management key data K_{MU}₍₁₎ to decrypt the package data Pj input at step
15 ST62 to obtain division condition information included in the package data Pj and the encrypted package data Pf.

Next, the processor 33 uses the division key data K_D to decrypt the package data Pf to obtain the system key data SYS_{K_F} and the uppermost area management key
20 data K_{MU_F} included in the package data Pf.

Step ST65:

The processor 33 of the IC card 16 encrypts by using the system key data SYS_{K_F} and the uppermost area management key data K_{MU_F} to generate degenerate key
25 data K_{A1}, performs mutual authentication with the memory

area division apparatus 14 by using the degenerate key data K_A1, and proceeds to the processing of step ST66 when both of the IC card 16 and the memory area division apparatus 14 confirm the legitimacy of each other.

5 In the above mutual authentication, for example, the memory area division apparatus 14 encrypts by using the system key data SYS_K_F and the uppermost area management key data K_MU_F to generate degenerate key data K_A2. Then, the memory area division apparatus 14 generates a
10 random number R1 and encrypts the random number R1 by using the degenerate key data K_A2 to generate data R1a. Then, the memory area division apparatus 14 outputs the random number R1 and the data R1a to the IC card 16. The IC card 16 verifies whether the data obtained by
15 decrypting the data R1a by using the degradation data K_A1 matches with the random number R1 and, when it matches, certifies that the memory area division apparatus 14 is the legitimate party. Also, by performing processing by an opposite standpoint from the above
20 processing by using the random number generated by the IC card 16, the memory area division apparatus 14 certifies that the IC card 16 is the legitimate party.

Step ST66:

The processor 33 of the IC card 16 shown in FIG. 2
25 divides the memory area of the memory 32 and, as shown in

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FIG. 22, forms the uppermost area AREA_MU_(1) assigned to the IC card issuer 21 and the uppermost area AREA_MU_F assigned to the card memory area user 24.

Step ST67:

5 The processor 33 of the IC card 16 stores (sets) the uppermost area management key data K_MU_F in correspondence with the uppermost area AREA_MU_F of the memory 32.

Step ST68:

10 The processor 33 of the IC card 16 uses the uppermost area management key data K_MU_F stored at step ST67 to decrypt the first issuance data INF_1 shown in FIG. 12 input at step ST63.

Step ST69:

15 The processor 33 of the IC card 16 stores in the memory 32 the system code SYSC_F included in the first issuance data INF_1 obtained by decrypting at step ST68.

Step ST70:

20 The processor 65 of the memory area division apparatus 14 judges whether the system code SYSC_(1) received from the IC card 16 at step ST61 in FIG. 2 is included in the registerable system code list RPSL shown in FIG. 15A stored in the memory 64 at step ST47 in FIG. 13 and, when included, judges that data related to
25 services provided by the card memory area user 24 can be

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registered in the IC card 16 and proceeds to the processing at step ST71.

In the communication system 1, as explained at steps ST43 and ST44, based on the rejection information RI_(i) by which the IC card issuer 21 specifies a party for which provision of services by using the same IC card 16 is rejected and the rejection information RI_F by which the card memory area user 24 specifies a party for which provision of services by using the same IC card 16 is rejected, an IC card issuer 21 capable of providing services by using the same IC card 16 as that of the card memory area user 24 is specified and the system code assigned to the specified IC card issuer 21 to generate the registerable system code list RPSL.

As a result, the IC card issuer 21 and the card memory area user 24 can avoid an undesirable party from providing services by using the same IC card 16.

Step ST71:

The processor 65 of the memory area division apparatus 14, when judged it can be registered at step ST70, outputs to the IC card 16 the encrypted area registration permission data INF_ARP shown in FIG. 15 stored in the memory 64 at step ST47 in FIG. 13 via the card interface 62.

The IC card 16 receives as input the encrypted area

registration permission data INF_ARP via the input/output interface 31 shown in FIG. 2.

As explained above, the area registration permission data INF_ARP is encrypted by the uppermost area

5 AREA_MU_F.

Step ST72:

The processor 33 of the IC card 16 shown in FIG. 2 decrypts the encrypted area registration permission information INF_RP input via the input/output interface
10 31 at step ST71 by using the uppermost area management key data K_MU_F read from the memory 64.

Step ST73:

The processor 33 of the IC card 16 shown in FIG. 2 stores the area management key code AMC_F and the area
15 management key data K_AM_F in the area registration permission information INF_RP decrypted at step ST72 in correspondence with the uppermost area AREA_MU_F formed at step ST66 in the memory 32 as shown in FIG. 23.

[Registration of File Data to IC Card 16 by
20 Operation File Registration Apparatus 15 (ST6)]

Next, the registration of file data to the IC card 16 by the operation file registration apparatus 15 performed at step ST6 shown in FIG. 8 will be explained.

FIG. 24 is a flowchart for explaining the
25 processing.

Step ST81:

The IC card holder 26 visits a store of the card memory area user 24 carrying the IC card 16 and loads the IC card 16 in the operation file registration apparatus

5 15.

Due to this, the processor 75 of the operation file registration apparatus 15 shown in FIG. 7 sends a file search request including information for specifying the card memory area user 24, such as a service code SC or system code SYSC_F, via the card interface 72 to the IC card 16.

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Step ST82:

When the input/output interface 31 receives the file search request at step ST81, the processor 33 of the IC card 16 shown in FIG. 2 searches whether or not file data of services relating to the card memory area user 24 is stored in the memory 32 based on the above information included in the file search request.

15

Step ST83:

When it is judged that the file data of the services relating to the card memory area user 24 is not stored in the memory 32 by the file search at step ST82, the processor 33 of the IC card 16 notifies that the file does not exist to the operation file registration apparatus 15 via the input/output interface 31.

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Step ST84:

When a notice of no file is received at step ST83, the processor 75 of the operation file registration apparatus 15 shown in FIG. 7 outputs file registration permission data FRP encrypted by the area management key data K_AM_F shown in FIG. 19B stored in the memory 74 at step ST54 shown in FIG. 17 via the card interface 72 to the IC card 16.

The IC card 16 shown in FIG. 2 receives as input the file registration permission data FRP via the input/output interface 31.

Step ST85:

The processor 33 of the IC card 16 shown in FIG. 2 decrypts the file registration permission data FRP input at step ST84 by using the area management key data K_AM_F, uses the file management key data K_FM_F in the decrypted file registration permission data FRP, and writes file management key data K_FM_F related to the service of the card memory area user 24 in the uppermost area AREA_MU_F shown in FIG. 23. As a result, the uppermost area AREA_MU_F becomes as shown in FIG. 25.

Step ST86:

The processor 33 of the IC card 16 shown in FIG. 2 writes the file management key data K_FM_F and the service code SC in the file registration permission data

FRP decrypted at step ST85 in correspondence with the
file data written at step ST85 in the memory 32.

[Charging Processing]

In the communication system 1, for example, the card
5 memory area operator 22 shown in FIG. 1 pays for the cost
of receiving the loan of the memory area of the memory 32
of the IC card 16 to the IC card issuer 21 for example in
units of blocks of the memory area.

Also, the card memory area operator 22 bills the
10 cost for use of part of the memory area of the memory 32
of the IC card 16 for the service of the card memory area
user 24 as a license fee, a service code SC registration
use fee, an area AREA registration fee, etc. to the card
memory area user 24.

As explained above, according to the communication
15 system 1, when the IC card issuer 21 issues the IC card
16 to the card holder 26, file data relating to services
provided by the card memory area user 24 can be
registered in the unused memory area of the memory 32 of
20 the IC card 16 based on predetermined conditions.

As a result, the card holder 26 can receive services
of both the IC card issuer 21 and the card memory area
user 24 by using the IC card 16 alone.

Also, according to the communication system 1, as
25 explained above, the package data Pj is generated through

the processing of the issuer communication apparatus 11
by using the Pf generated by the operator communication
apparatus 12, provided to the IC card 16 via the operator
communication apparatus 12 and the memory area division
5 apparatus 14, and decrypted in the IC card 16,
consequently the system code SYSC_F and the system key
data SYS_K_F necessary for writing the file data to the
memory area (uppermost area AREA_MU_F) used by the card
memory area user 24 in the IC card 16 can be kept secret
10 from the IC card issuer 21. Also, since the package data
Pj is decrypted by using the system key data SYS_K_(i) in
the IC card 16, the system key data SYS_K_(i) necessary
for writing the file data to the memory area (uppermost
area AREA_MU_F) used by the IC card issuer 21 can be kept
15 secret from the card memory area operator 22 and the card
memory area user 24.

Also, according to the communication system 1, by
respectively defining the areas AREA_(i) and AREA_F in
the uppermost area AREA_MU_(i) and the AREA_MU_F and by
20 using the area management data K_AM_(i) and K_AM_F to
write the file data to the AREA_F, illicit writing to the
memory area can be further effectively prevented.

Namely, according to the communication system 1, by
dividing the memory area of the IC card 16 and keeping
25 secret the key data used for a write operation of data on

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each of the divided memory areas from unauthorized persons, unauthorized access to the memory area can be prevented.

As a result, it becomes possible to get the unused
5 area which is not used by the IC card issuer 21 in the memory area of the IC card 16 used safely by a card memory area user 24 other than the IC card issuer 21 and possible to improve the convenience of the IC card 16.

The present invention is not limited to the above
10 embodiment.

For example, in the above embodiment, a case of setting various data to the memory area division apparatus 14 and the card memory area user 24 from the operator communication apparatus 12 after delivering the
15 memory area division apparatus 14 and operation file registration apparatus 15 to the card memory area user 24 was explained as an example, but the information may be set before delivering the memory area division apparatus 14 and the operation file registration apparatus 15 to
20 the card memory area user 24 under the control of the card memory area operator 22.

Also, a case of configuring the memory area division apparatus 14 and the operation file registration apparatus 15 as separate apparatuses was explained as an
25 example in the above embodiment, but they may be realized

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as a single apparatus.

Also, in the above embodiment, a case of setting the memory area division apparatus 14 and the operation file registration apparatus 15 in a store of the card memory area user 24 was explained as an example, but they may also be set in a store of the operator communication apparatus 12 etc.

Also, in the above embodiment, exclusive apparatuses were used as the memory area division apparatus 14 and the operation file registration apparatus 15, but the apparatuses may be realized by a personal computer etc. of the card memory area user 24 under the condition that it is an apparatus having a function of keeping secret data in accordance with need.

Below, an IC card system of an embodiment related to the above communication system 1 will be explained.

(1) Configuration of Embodiment (1-1) Basic Configuration

FIG. 27 is a block diagram of the configuration of an IC card system according to the present embodiment.

In FIG. 27, an IC card 3A/3B corresponds to the IC card 16 shown in FIG. 1.

Also, a card provider 2 corresponds to the card issuer 11 and the issuer communication apparatus 11.

Also, a lending business 5 and a management server

5A correspond to the card memory area operator 22 and the operator communication apparatus 12.

Also, an area user 6 corresponds to the card memory area user 24 shown in FIG. 1.

5 Also, an operation terminal 8 corresponds to the memory area division apparatus 14 and the operation file registration apparatus 15 shown in FIG. 1.

In the IC card system 101, the card provider 2 issues a non-contact type IC card 3A/3B free of charge or
10 by purchase by a user and performs processing of for example cashing, passage of turnstiles at train stations, etc. by access from the provider terminal 4A to 4N by using the IC card 3A/3B. Also, a memory space of the IC card 3A/3B left over after the above use for a service
15 relating to its own business is lent to a area user 6 desiring to use it by management of the lending business 5 or by its own management. Due to this, the IC card system 101 becomes capable of providing a variety of services not only to the card provider but to the area
20 user 6 by the IC card 3A/3B. Note that in the IC card system 101, a series of processing is executed by a computer under management of the card provider 2, the lending business 5, the area user 6, etc., however, in the explanation below, for simpler explanation and easy
25 understanding, the configuration of the IC card system

101 will be explained by suitably setting each of the card provider 2, lending business 5, and area user 6, etc. as main components.

Namely, in the IC card system 101, a card
5 manufacturer 7 produces the IC card 3A/3B upon order by
the card provider 2 and delivers it to the card provider
2. At this time, the IC card 3A/3B is issued by recording
a card code Ccd notified from the card provider 2 and a
division processing key notified from the lending
10 business 5 etc. Here, the card code Ccd is an
identification code unique to the IC card 3A/3B and
selected by the card provider 2 by a later explained
procedure. The division processing key is a key unique to
the IC card 3A/3B relating to processing for preparing a
15 system area separately. When the card provider 2 entrusts
management of empty areas of the IC card 3A/3B to the
lending business 5, the card provider 2 notifies the card
code Ccd to the lending business 5, pays a license fee,
obtains permission from the lending business 5, and
20 issues the IC card 3A/3B.

On the other hand, the card provider 2 is the entity issuing the IC card 3A/3B and selects the card code Ccd, notifies the same to the card manufacturer 7, and receives the IC card 3A/3B from the card manufacturer 7.

25 Also, when the IC card 3A/3B is delivered from the card

manufacturer 7, the card provider 2 accesses the IC card 3A/3B by an exclusive access apparatus, that is, a reader/writer, and sets the services to be usable by the IC card 3A/3B. Here, in the processing, the card provider
5 2 sets a system area in the memory space of the IC card 3A/3B by transfer of data encrypted by using a predetermined key and sets a user area of a predetermined number of blocks (n blocks).

The card provider 2 records data necessary for
10 accessing the user area, data necessary for updating the system area, data for specifying records of the system area, etc. in the system area and records files necessary for services expected to be provided in the user area.

Namely, the card provider 2 records area management
15 information indicating the recording positions of the files and not recorded areas in units of block in the system area and enables access to desired files requested from an external apparatus by the area management information. Also, a file key for encrypting processing
20 corresponding to the files, an application key applied to one service by a plurality of files, an area management key as an key for releasing encrypting corresponding to the card provider 2, and a system key for encrypting processing of all data to be input/output are recorded.
25 As a result, in the blocks of the user area set in the IC

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card 3A/3B, encrypting of data input from the provider
terminal 4A and 4B is released by a combination of the
corresponding system key, the application key, the area
management key, and the file key so that it is made
5 possible to write in a predetermined memory space.

Also, the system key, the area management key, the
application key, the area management key serving as a key
for managing the file key, etc. are recorded, the system
key etc. is updated only by access using the file
10 management key, and the application key and the file key
are made impossible to register or update.

Also, application codes unique to the services and a
system code for specifying recording of the system area
are recorded to enable the variety of services provided
15 by the IC card 3A/3B to be identified by the application
code and system code. Note that the IC card 3A/3B is
configured so that files relating to one service are
recorded in successive blocks, an address of the head
block of the successive blocks is assigned to the
20 application code, and thereby corresponding files are
recorded in the memory space by using the application
code as a reference. They are made to be accessible by
the area management information after being recorded.

If the IC card 3A/3B is made to be usable by
25 configuring the system area and user area as explained

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above, the card provider 2 provides the IC card 3A/3B to the card user for a fee or free of charge. Furthermore, when there is an access using the IC card 3A/3B from the provider terminals 4A and 4B serving as terminal

5 apparatuses of services offered by the card provider 2, a predetermined service is provided.

Thus, the provider terminals 4A and 4B modulate information to be used for transmission by a predetermined carrier in a built-in reader/writer to
10 drive a built-in antenna so as to repeatedly emit a call to the IC card 3A/3B at a predetermined cycle. Here, when the IC card 3A is held close to the antenna and a response to the call is sent from the IC card 3A, the reader/writer executes processing for mutual
15 authentication with the IC card 3A and judges whether or not mutual data communication with the IC card 3A is possible.

When it is judged by the mutual authentication that mutual data communication is possible, the provider
20 terminals 4A and 4B detect a response of the IC card 3A/3B to the call using the system code and thereby judge whether it is an IC card 3A/3B having a system area corresponding thereto or not. Furthermore, by obtaining a response of the IC card 3A/3B to the call using the
25 system management key and the application code, it is

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judged whether the IC card 3A/3B relates to its own service. When judged to be an IC card 3A/3B relating to its own service as explained above, the provider terminals 4A and 4B access the user area by transferring encrypted data by a combination of the system key, area management key, application key, and file key. For example when offering a service by electronic money, they execute processing for detecting an amount recorded on the IC card 3A, subtracting an amount used by the user from the balance, recording this in the IC card 3A, etc. Also, when the card provider 2 issues points for an amount of purchase by the user and offers a variety of services in accordance with the points, it executes processing for updating points etc. recorded on the IC card 3A in accordance with the amount of purchase by the user.

The IC card 3A/3B is a non-contact type IC card which starts to operate by power induced by the built-in loop antenna and performs processing on a high frequency signal induced to the loop antenna by a predetermined signal processing circuit so as to receive the call from the reader/writer. The IC card 3A/3B sends a response to the call, further executes processing for mutual authentication upon request from the reader/writer for the response, and thereby judges whether data exchange is

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possible with the reader/writer.

Furthermore, it transmits a collation result of the system code and application code recorded in the system area to the reader/writer in response to a call using the system code and application code from the reader/writer and therefore can execute a series of processing only when relating to a service scheduled to be provided by the reader/writer.

As a result, when confirmation is obtained by the reader/writer in this way, the IC card 3A/3B accesses corresponding files in accordance with access using the successively input system key, area management key, application key, and file key and thereby executes a series of processing by the file. Also, it secures an area for recording the file by updating the system area by access using the area management key and the system management key and updates the system area by receiving registration of the file key, application code, and application key.

(1-2) Division of Area

The card provider 2 yields the management right of the unused areas of the memory space of the IC card 3A/3B to the lending business 5 or lends the memory space to the area user 6 which desires to use the IC card 3A/3B by the lending business 5 while holding the management right

in its own hands. As a result, in this IC card system 101, even a terminal of the area user 6, that is, the operation terminal 8, can use services provided by the area user 6. Due to this, services of electronic money, ticketing, etc. offered by different businesses can be
5 utilized as desired by the user by for example the IC card 3A/3B of a commuter's pass.

Thus, the operation terminal 8 is installed in a store etc. of the user 6, provides services relating to
10 an operation by the area user 6, and sets the IC card 3A/3B to be able to use the services of the area user 6 etc. by an operation by the user in addition to the provision of these services.

FIG. 26 is a block diagram of a series of processing
15 in the case of transferring the management right of the unused areas therein to the lending business 5. Here, in the present embodiment, as shown in FIG. 28, the processing divides an empty area of the memory space into a predetermined number of blocks, separately sets a
20 system area (hereinafter, referred to as a new system area) formed by setting the manager as the lending business in the divided areas in the same way as explained above with reference to FIG. 27, and manages the divided areas by the new system area.

25 Thus, the lending business 5 records data necessary

for forming the new system area in the IC card 3A/3B by
access to the IC card 3B by the operation terminal 8
using the system area set by the card provider 2. At this
time, the lending business 5 secures a user area
5 corresponding to the number of blocks authorized by the
card provider 2, furthermore prevents the secret
information of the new system area, that is, the system
management key, area management key, etc. from being kept
secret from a third party including the card provider 2,
10 and thereby makes the user area used by the area user 6
unaccessible even by the card provider 2.

Therefore, the lending business 5 specifically
removes information relating to a file to be recorded on
the user area and encrypts information comprising the new
15 system area by an encrypting key corresponding to a
division processing key to generate a package Pf and
sends the package Pf to the card provider 2 together with
information specifying the IC card 3A/3B. Note that the
information here is prepared by information obtained by
20 removing information related to specific services, such
as a file key, application key, application code, etc.
from various information of the above system area
explained with reference to FIG. 28 arranged in a format
corresponding to the configuration of the system area.
25 Due to this, the lending business 5 keeps the area

management key, system management key, etc. set in the new system area secret from the card provider 2 and provides information used for generating the system area to the card provider 2.

5 Consequently, in the IC card system 101, by inputting/outputting information encrypted to enable release of the encrypting by a key for releasing encrypting recorded in the system area, that is, the system key, with the first terminal apparatus
10 corresponding to the recording of the system area explained with reference to FIG. 28, that is, the provider terminal 4A/4B, the IC card 3A/3B in which the memory space is accessed in accordance with the recording of the system area by the first terminal apparatus is
15 designed to encrypt information of the new system area corresponding to the system area to enable release of the encrypting by a predetermined area division key recorded in the IC card 3A/3B to generate encrypted information.

 After the predetermined server adds dummy data to
20 the thus notified package Pj in accordance with blocks lent to the lending business, the card provider 2 generates encrypted information by encrypting by the area management key and the system key and further encrypts by setting the application code etc. and system management
25 key etc. so as to record the encrypted information in

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successive predetermined blocks in the memory space by management of the system area explained above with reference to FIG. 28. As a result, the card provider 2 generates a package Pj relating to the same configuration as a data stream sent from the provider terminals 4A and 4B when recording a file relating to a predetermined application to the blocks lent to the lending business 5 and provides the package Pj together with the mutual authentication key and system code to the lending business 5. Consequently, the card provider 2 keeps the area management key and system management key etc. of the original system area which it manages itself secret from the lending business 5 and provides the package Pj generating the new system area and a corresponding user area to the lending business 5 together with the mutual authentication key etc.

As a result, the lending business 5 obtains from the card provider 2 the package Pj relating to the area setting processing for a predetermined number corresponding to the charging processing together with the mutual authentication key etc. by advance processing and provides the same to the area user 6 conditional on executing charging processing for setting areas at the card provider 2 and obtaining permission from the card provider 2.

As opposed to this, the operation terminal 8 executes processing for mutual authentication relating to the new system area with the IC card 3B in the same way as the provider terminals 4A and 4B by settings in advance and receives the mutual authentication key from the area user 6 and executes processing for mutual authentication with the IC card 3B by the mutual authentication key when mutual authentication is not obtained. Here, when mutual authentication has been achieved, the IC card 3B notifies that fact to the area user 6 since it is an IC card to which a new system area is not yet set.

Accordingly, the area user 6 instructs to secure an area corresponding to the IC card 3B by sending the package Pj to the operation terminal 8. Due to the instruction, the operation terminal 8 uses the record of the previous system area related to usage of the provider terminals 4A and 4B and records information of the package Pj in a predetermined area of the IC card 3B. As a result, in the IC card system 101, the IC card 3B is made to secure a user area corresponding to the new system area. Also, corresponding to the encrypting processing of the package Pf by the card provider 2 at this time, it releases encrypting by the system key and area management key set in the original system area of

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the IC card 3B, the records by releasing encrypting by the division processing key and thereby forms the same new system area as the system area of the provider terminals 4A and 4B.

5 Also, the system sets the user area to be hard to access even by the card provider 2 by various kinds of keys set in the new system area and accordingly can completely entrust management of the memory space to the lending business 5.

10 As a result, in the IC card system 101, by setting the new system area by the lending business 5 in the memory space of the IC card 3A/3B and dividing the memory space as explained above, the management right of the thus divided memory space is transferred from the card
15 provider 2 to the lending business 5.

Due to this, in the IC card system 101, in the same way as execution by the card provider 2 by management of the memory space by the original system area by using the provider terminals 4A and 4B, for example, by management
20 of the memory space by the new system area using an exclusive terminal apparatus by the lending business 5, the lending business 5 can also provide a variety of services by managing the IC card 3A/3B.

In the above way, in the IC card system 101, a
25 management computer at the card provider 2 side comprises

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a second encrypting means for further encrypting the encrypted information, that is, the package Pj, to enable release of the encrypting by the area management key recorded in the previous system area, to generate the

5 second encrypting information, that is, the package Pj, comprises an input means for an operation terminal 8 to input the package Pj to the IC card 3A/3B by access of the IC card 3A/3B corresponding to the recording in the first system area, that is, the previous system area, by

10 access of the IC card 3A/3B using the mutual authentication key of the provider terminals 4A and 4B by the operation terminal 8, and releases the encrypting of the package Pj in the IC card 3A/3B and records information of the new system area in the memory space of

15 the IC card 3A/3B by access of the IC card 3A/3B corresponding to the first terminal apparatus.

(1-3) Lending of Memory Space

The lending business 5 lends memory space to the area user 6 which desires to use the IC card 3A/3B with

20 respect to the divided memory space when dividing the memory space of the IC card 3A/3B and receiving part of the management right in this way or with respect to the entrusted memory space when the lending of the memory space is entrusted by the card provider 2 while the card

25 provider 2 keeps the management right at its own hands.

As a result, in the IC card system 101, even more types of businesses can offer a variety of services using the IC card 3A/3B in common.

In the lending processing, when the card provider 2 and area user 6 do not desire to provide services using a single IC card 3A/3B in common, the lending business 5 limits the lending of the memory space by rejection processing. Due to this, for example, the memory space of the IC card 3A/3B is not lent for a service of a certain provider in a rival relationship with the card provider 2. Further, lending processing is selectively performed for an IC card 3A/3B relating to a rate desired by the area user 6. Due to this, the area user 6 can reject lending for example for an IC card 3A/3B of a high lending rate.

(1-3-1) Registration of Service

FIG. 30 is a block diagram for explaining pre-processing of the rejection processing in the IC card system 101. Namely, in the IC card system 101, the lending business 5 obtains from the IC card issuer 21 lending conditions together with the card code Ccd as to the IC card 3A/3B entrusted to be lent at the time of requesting production of the IC card 3A/3B to the card manufacturer 7 by the card provider 2 etc. Here, the lending conditions include rejection conditions of the

application (APL), price of the area, and expiration date; the rejection conditions of an application include sectors and businesses for which lending is rejected and other data specifying services (for example, an
5 application code); and the price of the area includes data for specifying a fee of one block relating to lending. Also, the expiration date is composed of data for specifying a lending period. As a result, when rejecting lending in this way, for example, a case of
10 prohibiting use of the IC card 3A/3B by rival businesses etc. may be considered.

The lending business 5 records the thus obtained card code Ccd and the lending conditions in a management server 5A and thereby prepares a card code list formed by
15 recording the card code Ccd and the lending condition of the IC card 3A/3B. Furthermore, the lending business 5 approves the card code Ccd for access from the card manufacturer 7.

Furthermore, the lending business 5 has the area
20 user 6 which desires to use the IC card 3A/3B set the operation terminal 8 and makes the operation terminal 8 function as a registration apparatus so that the area user 6 can register services. The area user 6 can access the IC card 3A/3B from the operation terminal 8 and use
25 it for a variety of services.

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The lending business 5 records information of the services to be registered from the operation terminal 8 in the management server 5A to generate a registration machine code list and an application code list shown in FIG. 31 and executes the rejection processing by judgement made by comparing these lists with the card code list.

Namely, when the lending business 5 authorizes the area user 6 to use the IC card 3A/3B by a contract with the area user 6, it issues an unused registration machine code Mod to the area user 6 when there is an issuance request of a unique registration machine code Mod from the area user 6 to the operation terminal 8. When issuing the registration machine code Mcd in this way, the management server 5A records a business code indicating that the operation terminal 8 relating to the registration machine code Mod is related to the area user 6 and an application (APL) code of the services which the operation terminal 8 is scheduled to operate and prepares a registration machine code list thereby. Note that when starting a new services of the area user 6 by the existing operation terminal 8, this can be dealt with by updating contents of a corresponding registration machine code at the time of requesting to obtain the application code related to the new services.

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In the IC card system 101, when the registration machine code Mcd is notified from the lending business 5 to the area user 6 as explained above, the area user 6 asks a registration machine manufacturer 10 for delivering an operation terminal 8 by the registration machine code Mcd. In this case, by the request for permission from the registration machine manufacturer 10, the lending business 5 approves production of the operation terminal 8 with the registration machine code Mcd. Thus, in the IC card system 101, the registration machine manufacturer 10 produces the operation terminal 8 by recording the registration machine code Mcd, the operation terminal 8 is delivered to the area user 6, and a license fee is charged in this case.

In the IC card system 101, for an operation terminal 8 delivered to the area user 6 explained above, when the area user 6 requests issuance of an application code relating to the new services by the operation terminal 8, the lending business 5 selects an unused application code, notifies the same, and updates contents of the registration machine code list by the application code. Furthermore, the number of blocks of the IC card 3A/3B relating to lending set by the contract, rejection conditions of the IC card (rejection conditions of a card code) which the lending business 5 does not desire to

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use, etc. are recorded in the management server 5A along with a corresponding application key so as to prepare the application (APL) code list. Note that in FIG. 31, the rejection conditions of the card code are records of card codes of the IC cards which the lending business 5 does not desire to use, specifically, card codes and usage fees per block for use, etc. As a result, as such a case, a case where a rival business of the area user 6 is the card provider 2, a case of a high usage rate, etc. may be considered.

When preparing a list in this way, as shown in FIG. 32, the lending business 5 compares conditions for recording to the card code list with conditions for recording to the application code list for every application code and card code and thereby prepares a list of registration permission information for registering services to the IC card 3A/3B except for combinations of registration of services by the area user 6 which the card provider 2 does not desire and combinations of registration of services to the IC card 3A/3B which the area user does not desire etc.

At this time, the lending business 5 sends the registration permission information from the operation terminal 8 to the IC card 3A/3B, records an application code and an application key corresponding to the IC card

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3A/3B in the IC card 3A/3B, and prepares a list by recording the registration permission information so that the number of blocks for recording corresponding files can be secured. Note that when the lending business 5 is only entrusted with lending of a memory space, since the area management information, system key, and system management key recorded in the system area necessary for preparing such registration permission information are known only by the card provider 2, information of the application code, application key, and number of blocks are notified to the card provider 2 and registration information is generated by encrypting processing by the card provider 2. As opposed to this, when providing services in a memory space corresponding to the system area by registering the information to the system area managed by the lending business, since area management information, system key, and system management key recorded in the system area are known only by the lending business 5, the registration information is generated by processing of the lending business 5 by itself.

When data exchange is started between the operation terminal 8 and the IC card 3A/3B in a state where the application registration list is prepared in advance as explained above, when the system area relating to the operation terminal 8 is not formed in the IC card 3A/3B,

the system area is formed and then existence of a record of an application code relating to the services of the operation terminal 8 is confirmed in the operation terminal 8. Here, when the application code is not
5 recorded in the IC card 3A/3B, it is considered that files relating to the services of the operation terminal 8 are not yet registered in the IC card 3A/3B. At this time, when a plurality of services are provided by the operation terminal 8, the operation terminal 8 issues a
10 command to the IC card 3A/3B to successively read the application code and detects services which are not yet registered from the read application code. Furthermore, existence of provision of thus detected services which are not yet registered is confirmed for the user which
15 carries the IC card 3A/3B. If the user desires a service here, the registration machine code and service code are notified to the lending business 5 via the area user 6.

Furthermore, when searching through the application registration list by using a search result of the
20 registration machine code list by the registration machine code as a reference and recording registration permission information as a registerable service, the registration permission information of the corresponding application is notified from the application registration
25 list to the operation terminal 8. On the other hand, when

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registration permission information of the corresponding application is not registered, since registration is difficult due to the above rejection processing, the user is informed of it via the operation terminal 8.

5 In the IC card system 101, a registration key K used for registering a file necessary for providing a service is also notified from the area user at the time of notifying the registration permission information to the operation terminal 8. The operation terminal 8 accesses
10 the IC card 3B by the registration permission information to enable registration of a file and file key relating to a service. Then, by accessing the IC card 3B using the registration key K notified from the area user 6, the file and corresponding file key relating to the service
15 are registered. Thus, in the IC card system 101, the area user 6 uses the memory space lent from the lending business 5 or the area user 6 uses the memory space lent from the card provider 2 and the lent memory space is managed by the file key kept by the area user 6, so a
20 variety of services can be provided.

When the services become available in this way, the operation terminal 8 prints a sticker indicating the newly usable service by a built-in printer and provides the sticker to the user of the IC card 3B. As a result,
25 in the IC card system 101, even in the case where a large

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number of services are recorded in the IC card 3B, the user can confirm the available services by adhering the stickers on the IC card 3B. Note that instead of printing such a sticker, it is possible to directly print the
5 information on the IC card 3B.

As explained above, when a service becomes available by the IC card 3B, the lending business 5 performs charging relating to collection of fees at the time of registration in the area user 6 and charging relating to
10 payment of the registration fee in the card provider 2. Furthermore, the registration is listed for each card code of the IC cards and records left. The lending business 5 performs charging for use of the card for example in units of months by periodic tabulation of the
15 records.

Note that the series of processing of the data processing method of the present invention can be executed by hardware, but can also be executed by software (program). When executing the series of
20 processing by software, it is possible to install the software from a storage medium or downloaded it via a network into a computer incorporating a program comprising the software in exclusive hardware or a general-use personal computer capable of executing a
25 variety of functions by installation of a variety of

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programs etc.

As explained above, according to the present invention, it is possible to provide a data processing method and system, a portable device, a data processing apparatus and method, and a program which can deal with a variety of demands including security aspects of a service provider when a plurality of businesses share a single IC card etc.

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